27th ECCMID Vienna, Austria 22 – 25 April 2017
The congress of ESCMID

Session: P005 Infection control for MRSA and VRE

Category: 8f. Disinfection & biocides

22 April 2017, 15:30 - 16:30
P0097

MRSA decolonization failure due to biofilm formation

Frank Guenther*[1], Evelina Tacconelli[2], Brigitte Blessing[3], Nico Tom Mutters[1]

[1]*Heidelberg University Hospital; Department of Infectious Diseases; Department of Infectious Diseases*

[2]*Medizinische Klinik, Universitätsklinikum Tübingen; Infectious Diseases; Dept. for Internal Medicine I*

[3]*Department of Infectious Diseases*

Background: Biofilm forming methicillin-resistant Staphylococcus aureus (MRSA) are a common clinical problem. Biofilm formation as a reaction to therapeutic interventions can lead to increased antimicrobial resistance, which is more and more recognized as an infection control problem. Treatment and decolonization failure may occur more frequently when topical drugs or disinfectants are used against biofilm forming MRSA. The goal of our study was to evaluate to what extent the formation of biofilms influenced the efficacy of topical decolonization or disinfectant agents i.e. mupirocin (MUP), octenidine dihydrochloride (OCT), chlorhexidine digluconate (CHG) and polyhexanide (PHX).

Material/methods: Bacterial killing in biofilms was determined as reduction [%] of metabolic activity using a kinetic biofilm viability assay as previously described [1]. Briefly, the test substances were diluted in water with standardized hardness (WSH) at 25°C in standard concentration as well as half the standard concentration to demonstrate dilution effects in the practical setting. The tested concentrations and exposure times were: CHG 1%, 2%; OCT 0.1%, 0.05%; PH 0.04%, 0.02% and 15 s, 1 min, 3 min, 5 min, 10 min, and 20 min, respectively.
Additionally, bactericidal effects of all substances were tested on planktonic bacteria and measured as log10 reduction.

Results: The disinfectants OCT and CHG showed good efficacy in inhibiting MRSA in biofilms with reduction rates of 94±1% and 91±1%, respectively. PHX had a maximum efficacy of 81±7% only. Compared to tested disinfectants MUP showed a significantly lower efficacy reaching only <20% ($p < .05$). Bactericidal effects were greatest for CHG (log10 reduction of 9.0), followed by OCT (7.7) and

PHX (5.1). MUP, however, showed a very low bactericidal effect of 2.1 only, even when exposure time was increased to 24h.

Conclusions: Our data provide evidence that OCT and CHG are effective components for disinfection of MRSA-biofilms. On the other hand, exposure to MUP in standard concentration of topical preparations did not effectively inhibit MRSA-biofilms. The biofilm probably provides a physical barrier for MUP so that only insufficient concentrations are reached in the bacteria. Biofilm formation might accelerate resistance development since bacteria in biofilms simply have more time to adapt to low concentrations of mupirocin. Biofilms might be the missing link in understanding the rapid development of resistance when mupirocin-based regimens are used routinely among general inpatient populations. Our data suggest that combining the mupirocin-based decolonization regimen with a disinfectant such as OCT or CHG, decolonization failure might be decreased.

1. Günther F, et al.: Comparative testing of disinfectant efficacy on planktonic bacteria and bacterial biofilms using a new assay based upon kinetic analysis of metabolic activity. J Appl Microbiol 2016.